DEVICE FOR THE CONTROLLED DISTRIBUTION OF PULVERULENT PRODUCTS

The object of the present invention is a device for the controlled distribution of pulverulent products, including a feed container for said product having an outlet aperture sealed by a rotor provided with a plurality of transfer cavities, each of which comprises an inlet aperture and an evacuation aperture, the paths of said inlet apertures successively passing opposite said outlet aperture in order to be filled with said product and said evacuation apertures passing successively opposite a distribution aperture connected to means to evacuate said pulverulent product from said transfer cavities, for emptying therein, of the sealing surfaces of said inlet and evacuation apertures disposed along said respective paths and means to drive said rotor.

Such a device has already been proposed in WO 01/26863 to feed an abrasive particle projection system. It comprises a disk-shaped rotor provided with a series of cylindrical cavities distributed

uniformly along a circle centred on the rotational axis of the disk, the axes of which are parallel to this rotational axis. This disk is sandwiched between two plates fixed together leaving just enough clearance for the disk to rotate. One of the plates has an aperture communicating with the outlet of a pulverulent product feed hopper, which is located on the path of the disk cavities. The other plate also has a distribution aperture located on the same path which is coaxial to another aperture passing through the first plate and linked to a pressurised air source, such that every time a cavity filled with powder passes between both coaxial apertures, the powder is discharged into the distribution aperture by the fluid pressure.

If the principle of this dosing device is reliable, its implementation has several disadvantages in its manufacture and operation, as well as in the concentration uniformity of the distributed powder.

It can be noted that a major problem is the problem of guiding the disk between both sealing plates which cover each of its faces. This results notably from the fact that the disk is integral with a drive shaft pivotally mounted as a result of two rollers integral with both respective plates. Given that the clearance between the disk and the sealing plates must be as small as possible in order to prevent escape of the powder which is held within the cavities by the adjacent faces of the sealing plates between which the disk rotates, yet that the disk

must however be able to rotate without causing excessive heating, the difficulty of the problem to be resolved is apparent.

In this device, the inlet aperture of the first sealing plate and the distribution inlet of the second sealing plate are diametrically opposed. The reason for this arrangement was that it was thought necessary to have a sufficient distance between both apertures to ensure effective sealing to prevent the powder contained within the cavities from escaping. Given that it is however impossible to ensure total containment of the powder by this means, sooner or later the result is the formation of a film of powder between the adjacent faces of the disk-rotor and sealing plates, which brakes the disk and causes excessive heating.

It can also be mentioned that the cavities of the disk-rotor are comparatively large and spaced apart, such that the concentration of the powder as a function of time fluctuates more or less sinusoidally.

The aim of the present invention is to overcome, at least in part, the above-mentioned disadvantages.

To this end, the object of this invention is a device for the controlled distribution of pulverulent products according to Claim 1.

The main advantage of this solution is that it gives

a degree of freedom to the transfer cavities in relation to the sealing surfaces, allowing optimal contact between these surfaces and the apertures of the transfer cavities without the likelihood of overheating, considerably reducing the precision stresses. Moreover, advantageously, the rotational axis of the moving parts is itself and directly the positioning reference between the moving parts and the fixed parts of the device, already ensuring precise guiding of the rotor.

As a result of this arrangement, the tolerances between these fixed and movable parts can be further reduced insofar as direct guiding eliminates the tolerances resulting from the fact that both guiding surfaces between the fixed and movable parts and between the latter and the drive means are concentric surfaces which are both arranged on the disk-rotor itself, which provides for a large degree of precision without particular difficulty. The degree of freedom provided to the transfer cavities and the reduction of these tolerances allow the likelihood of the pulverulent product escaping to be reduced and as a result the likelihood of the disk-rotor blocking and heating.

Another consequence of this greater flexibility and greater guiding precision means that it becomes possible to substantially reduce the distance between the outlet aperture of the feed hopper filling the transfer cavities of the rotor and the distribution aperture of the pulverulent product.

Therefore, it becomes possible to considerably reduce the size of the sealing surfaces of the transfer cavities between these outlet and distribution apertures, as it is sufficient to cover a small part of the surfaces of the disk-rotor alone, such that the greater part of these surfaces can be free, further reducing thereby the likelihood of the powder clogging between the disk-rotor and the sealing surfaces of the cavities of this disk-rotor.

The appended drawing shows schematically and by way of example an embodiment and an alternative of the device for the controlled distribution of pulverulent products, which is the object of the present invention.

Figure 1 is a general view of an abrasive particle projection apparatus;

Figure 2 is a perspective view of the device for the controlled distribution of pulverulent products, which is included in this abrasive apparatus;

Figure 3 is a sectional view along line III-III of Figure 2;

Figure 4 is a sectional view along line IV-IV of Figure 2;

Figure 5 is a sectional view similar to that of Figure 4 showing an alternative.

Although Figure 1 shows by way of example the device which is the object of the invention for the feeding of an abrasive particle projection apparatus, this device is in no way limited to this application but can be used instead in all applications where a pulverulent substance must be continually distributed in doses.

The pulverulent material to be distributed is contained in a feed hopper 1, the outlet of which is in communication with an inlet aperture 2 of the distribution device. This inlet aperture 2 passes through upper part 3a of a supporting structure 3 and is in communication with an inlet aperture 4 of an upper sealing clamp 5a. One surface of this upper clamp 5a, which is integral with upper part 3a of supporting structure 3, is in frictional contact with the upper surface of a dosing disk-rotor 6 and forms the active sealing surface of this sealing clamp 5a. Dosing disk-rotor 6 is provided with two circular and concentric series of cylindrical transfer cavities 7, 8 passing through an annular portion 6a of dosing disk 6, the paths of which pass through inlet apertures 2, 4. The cylindrical transfer cavities of these two circular series are half a pitch apart, such that the amount of pulverulent product distributed is substantially constant as a function of time.

Lower part 3b of supporting structure 3 is integral with a lower clamp 5b, the active surface of which, which is in frictional contact with the lower surface of annular portion 6a of dosing disk 6, forms a sealing surface.

The centre of dosing disk 6 comprises a tubular hub 6b which extends on either side of this disk 6 and which is used to receive the inner raceways of two ball bearings 9a, 9b, the outer raceways of which are integral with both upper 3a and lower 3b parts respectively of supporting structure 3. Tubular hub 6b of disk 6 is linked to annular part 6a through which cylindrical transfer cavities 7, 8 pass by means of a tapered circular part 6c designed to impart a degree of resilient freedom to annular part 6a perpendicular to the sealing surfaces of clamps 5a, 5b, enabling uniform distribution of the frictional forces of sealing surfaces 5a, 5b between both faces of annular part 6a.

As can be seen in Figure 4, upper part 3a of supporting structure 3 comprises an aperture 10 which is in communication with an aperture 11 formed through upper sealing clamp 5a, located in annular portion 6a of dosing disk 6 inside which both circular series of cylindrical transfer cavities 7, 8 are formed. As illustrated by Figure 1, these apertures 10 and 11 are linked to a pressurised air source 12.

Lower part 3b of supporting structure 3 also

comprises a distribution aperture 13 which is in communication with a distribution aperture 14 formed through lower sealing clamp 5b. These distribution apertures 13 and 14 are aligned with apertures 10, 11 which pass through the upper part of the supporting structure and upper sealing clamp 5a respectively, such that these apertures 10, 11 are in communication with distribution apertures 13, 14 through both circular series of cylindrical transfer cavities 7, 8 of dosing disk 6, the paths of which pass through apertures 10, 11, 13 and 14.

As can be noted in Figure 2, the angular distance, in relation to the centre of dosing disk 6, between inlet apertures 2, 4 and distribution apertures 13, 14 is less that 90° and is in fact, in this example, even less than 45° between the centres of both apertures 2 and 13.

Until now, it was thought necessary to have as large an angle as possible between the inlet and the distribution of the pulverulent product to ensure closure of the transfer cavities of circular series 7, 8 of dosing disk 6 when they transport the pulverulent substance from inlet 2, 4 towards distribution 13, 14. It is for this reason that the angle was 180°. It was noted that if the positioning of both sealing clamps 5a, 5b was carried out taking as a reference the axis of dosing disk 6, the resulting precision allows for a closing effect which is practically unaffected by the distance between the inlet and the distribution, due to the

very large degree of guiding precision between dosing disk 6 and sealing clamps 5a, 5b. This precision allows for precise contact between disk 6 and clamps 5a, 5b. Due to the smaller frictional surface between disk 6 and clamps 5a, 5b, the device, which is the object of the invention, allows heating to be reduced. Dosing disk 6 is rotated by a shaft 15 of a drive gear motor M (Figure 1). This shaft 15 is made rotationally integral with dosing disk 6 by key 16.

The operation of the device for the controlled distribution of pulverulent products described above consists in filling feed hopper 1 with the pulverulent product to be distributed. This hopper 1 can comprise any adequate device to prevent clogging of the pulverulent product at its outlet and guarantee even flow of this product. Such a device is not part of the present invention, such that it has not been shown, insofar as it was not useful for the understanding of the invention.

Dosing disk 6 is rotated by gear motor M and shaft 15. As both circular series of apertures 7, 8 pass under inlet apertures 2, 4 through upper part 3a of supporting structure 3 and upper clamp 5a, transfer cavities 7, 8 fill with pulverulent material through their inlet apertures adjacent to the upper surface of dosing disk 6. Lower sealing clamp 5b closes the distribution apertures of these cylindrical transfer cavities 7, 8 adjacent to the lower surface of dosing disk 6. As this dosing disk 6 moves towards

distribution apertures 13, 14 which pass through lower sealing clamp 5b and lower part 3b of supporting structure 3, upper sealing clamp 5a closes the inlet apertures of cylindrical transfer cavities 7, 8, thus precisely limiting the volume of pulverulent material transferred towards the distribution apertures for each cylindrical cavity 7, 8.

When these transfer cavities 7, 8 arrive opposite distribution apertures 13 and 14 and apertures 10 and 11 linked to the pressurised fluid source 12, they put distribution apertures 13, 14 in communication with this pressurised fluid source, such that the pulverulent material which is in cylindrical transfer cavities 7, 8 is ejected through distribution apertures 13, 14.

In the alternative shown by Figure 5, dosing disk 6' is formed with two concentric parts 6'a, 6'c linked together by a series of floating rivets 18, such that the degree of freedom of outer annular part 6'a which supports transfer cavities 7, 8 is further increased.